Recheck the setups and calculations you see.
Rev. B, WEV, 2/27/2025

Part 1, calculate the original acid concentration.

60.0 mL of pH 4.500 solution. How much water must be added to raise pH to 5.500?

$10^{-4.500} = 3.16227766 \times 10^{-5}$ M

$K_a = 1.50 \times 10^{-6}$

	[HA]	$[H^+]$	$[A^-]$
Initial	$[HA]_0$	0	0
Change	$-3.16227766 \times 10^{-5}$	$+3.16227766 \times 10^{-5}$	$+3.16227766 \times 10^{-5}$
Equilibrium	$[HA]_0 - 3.16227766 \times 10^{-5}$	$3.16227766 \times 10^{-5}$	$3.16227766 \times 10^{-5}$

$K_a = [H^+][A^-]/[HA]$

$1.50 \times 10^{-6} = (3.16227766 \times 10^{-5}) * (3.16227766 \times 10^{-5}) / ([HA]_0 - 3.16227766 \times 10^{-5})$

$1.50 \times 10^{-6} = (1.00 \times 10^{-9}) / ([HA]_0 - 3.16227766 \times 10^{-5})$

$(1.50 \times 10^{-6}) * ([HA]_0 - 3.16227766 \times 10^{-5}) = (1.00 \times 10^{-9})$

$(1.50 \times 10^{-6}) * ([HA]_0) - (4.74341649 \times 10^{-11}) = (1.00 \times 10^{-9})$

$(1.50 \times 10^{-6}) * ([HA]_0) = (1.047434165 \times 10^{--9})$

$[HA]_0 = 6.982894433 \times 10^{-4}$ M

$[HA] = 6.982894433 \times 10^{-4} - 3.16227766 \times 10^{-5} = 6.666666667 \times 10^{-4}$ M

Part 2, calculate the amount of water in the final solution.

$10^{-5.500}$ = 3.16227766 x 10^{-6} M

K_a = 1.50 x 10^{-6}

V_0 = 60.0 mL = 0.0600 L

moles HA = 0.0600 * 6.666666667 x 10^{-4} = 4.00 x 10^{-5}

V = volume final solution

	[HA]	[H^+]	[A^-]
Initial	4.00 x 10^{-5} / V	0	0
Change	-3.16227766 x 10^{-6}	+3.16227766 x 10^{-6}	+3.16227766 x 10^{-6}
Equilibrium	4.00 x 10^{-5} / V - 3.16227766 x 10^{-6}	3.16227766 x 10^{-6}	3.16227766 x 10^{-6}

$K_a = [H^+][A^-]/[HA]$

1.50 x 10^{-6} = (3.16227766 x 10^{-6}) * (3.16227766 x 10^{-6}) / (4.00 x 10^{-5} / V - 3.16227766 x 10^{-6})

1.50 x 10^{-6} = (1.00 x 10^{-11}) / (4.00 x 10^{-5} / V - 3.16227766 x 10^{-6})

(1.50 x 10^{-6}) * (4.00 x 10^{-5} / V - 3.16227766 x 10^{-6}) = (1.00 x10^{-11})

(6.00 x 10^{-11} / V) - (4.7434164 x 10^{-12}) = (1.00 x10^{-11})

(6.00 x 10^{-11} / V) = (1.47434 x 10^{-11})

1/ V = 0.2457233333

V = 4.06961759 L

V – V_0 = 4.0096 L